

Missouri Diamond Grinding of PCCP Update

Diamond Grinding of Route 60, Butler County

Project Description

In 1996, MoDOT began reviewing a proposal to use diamond grinding as a means to provide texture and a smooth profile in place of transversely tined finish on newly constructed PCCP. Research has found that the smoother a pavement is initially, the better it's going to perform over time and the longer it's going to last. Because of this, it is believed that this method of construction would produce a smoother and more durable pavement at a comparable cost per mile. Diamond grinding can lower the profile index by 50% or more on newly constructed pavement and could produce a very smooth ride.

Two projects were selected for this investigation to provide a comparison between the diamond ground surface and the standard transverse tined surface. The two projects were located on Route 60, Butler County. The same contractor constructed the two projects during the summer of 1997, using the same equipment and material. The only difference was in the finishing technique; one was transversely tined while the other had a burlap drag finish with diamond grinding taking place within approximately one month of construction. The two projects are being monitored on an annual basis by means of a visual distress survey, profilograph measurements using the 0.0 blanking band, Automated Road Analyzer (ARAN) data, falling weight deflectometer (FWD), and friction properties.

The following is a summary of specifications for diamond grinding on this project:

- Use a burlap drag instead of transverse tining.
- Seal the joints so the sealant remains $\frac{1}{4}$ " to $\frac{3}{4}$ " below the pavement surface.
- Require a 21-day cure and a minimum of 3500 psi compressive strength before diamond grinding.
- Use a diamond grinding head of at least 3 feet wide, with 55 to 60 grooves per foot.
- Allow an extra 0.2 inch for deficient pavement thickness because of diamond grinding.
- Base deductions for roughness on the profile index before grinding and smoothness- incentive pay on the profile index after diamond grinding.

MoDOT also tightened the requirement for incentive pay by requiring an index of 10 inches per mile or less for a 5% bonus and 5 inches per mile or less for a 7% bonus.

Construction

The concrete paving contractor was Illinois Valley Paving Co., Winchester, Illinois and the subcontractor for the diamond grinding operation was Concrete Textures Inc, Des Moines, Iowa. Illinois Valley Paving's effort on the paving portion of the job produced an average profile index of 18.1 inches per mile, smooth enough for 100% pay, before diamond grinding. However, after the diamond grinding was performed, the average profile index dropped to 6.8 inches per mile, with one day's grinding at 5.0, earning a bonus of 7%. The tined pavement had an average profile index of 17.0 inches per mile following construction, earning a 3% bonus.

Results

Table 1 includes smoothness and serviceability data for the two surface finishes.

Table 1

| | Profile index (avg.) | | PSR (avg.) | | IRI (avg.) | |
|------------------|----------------------|---------------|------------|---------------|------------|---------------|
| | Initial | After 2 years | Initial | After 2 years | Initial | After 2 years |
| Diamond Ground | 6.3 | 6.7 | 35.8 | 35.1 | 62.4 | 87.2 |
| Transverse Tined | 17 | 16.5 | 34.1 | 33.9 | 91.8 | 82 |

Profograph measurements were collected using the zero blanking band and indicate some very smooth pavement in the diamond ground and the transversely tined sections. The initial smoothness of the diamond ground pavement was smoother than the tined pavement and continues to maintain a lower profile index than the conventional tined pavement. The IRI's after 2 years of service are comparable for the two finishes. The PSR's for both the diamond grinding and the tined pavements are good.

The Falling Weight Deflectometer (FWD) has been performing annual tests since the completion of construction. The analysis of the FWD data indicates that all the pavement components are structurally sound for the diamond ground and the transversely tined pavement. The average joint load transfers were all above 70%, the standard recommended for adequate load transfer, with most at or above 80%. The average deflections were minimal, in the range of 2-3 mils. FWD data will continue to be collected every three years.

To date, it is observed that the diamond ground pavement provides adequate friction properties and is comparable to the transversely tined pavement.

The project has been open to traffic for only two years, so final conclusions cannot be drawn at this time. However, after two years of service, it can be stated that diamond grinding as a finishing technique does produce a quieter and smoother ride than normally transverse tined pavement. Testing, with the exception of the FWD, will continue to be performed on an annual basis.

Project Costs

The long-term advantages of an extended service life, requiring less maintenance and with a more comfortable ride to the traveling public, should offset the initial additional cost of the diamond grinding. The cost per square yard for the placement of the concrete was \$23.47 with an additional \$1.53 per square yard for diamond grinding. A cost per mile comparison between the diamond ground pavement and the conventionally tined pavement finish is shown in Table 2.

Table 2

| | | |
|------------------|--|---------------------|
| Diamond Ground | 38' wide paving (24' wide diamond grinding) | \$544,766.45 / mile |
| Transverse Tined | 38' wide paving | \$523,224.45 / mile |

It is also expected that if diamond grinding is approved as an acceptable texturing procedure, money may be saved on the initial placement of the concrete because of less stringent requirements on concrete smoothness and the decreased labor needed to finish the pavement before diamond grinding takes place.

Contact:

If you would like further information, please contact:
Patty Brake Lemongelli
Phone: (573) 526-4328
E-mail: lemonp@mail.modot.state.mo.us

Dave Amos
Phone: (573) 526-4316
E-mail: amosd1@mail.modot.state.mo.us